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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/716,016	11/16/2000	Steven T. Mayer	M-7125-2D US	7163

7590

01/06/2003

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EXAMINER

LEADER, WILLIAM T

ART UNIT

PAPER NUMBER

1741

DATE MAILED: 01/06/2003

9

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/716,016

Applicant(s)

MAYER ET AL.

Examiner

William T. Leader

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 27 September 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 19,21-25 and 29-39 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 19,21-25 and 29-39 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

1. Receipt of the papers filed on September 27, 2002, is acknowledged. Claims 19, 21-25 and 29-39 are pending.
2. At page 4 of the Remarks, applicant states that Reid et al is disqualified as prior art under 35 .S.C. 103(c), as it is a 102(e) reference and its subject matter and the present invention were, at the time the invention was made, owned by the same entity or subject to an obligation of assignment to the same entity. Applicant has provided assignment reel and frame numbers for the Reid et al patent and the claimed invention. Accordingly, the rejections of record based of Reid et al are withdrawn.
3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim Rejections - 35 USC § 103

4. Claims 19, 21 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dubin (5,972,192) in view of the Condensed Chemical Dictionary and either of Lashmore (4,461,680) or Wright, Jr. (4,563,399).
5. The Dubin et al patent is directed to a process for electrodepositing a metal such as copper onto a seed layer on the surface of a semiconductor wafer. The

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copper electroplating solution employed is conventional and may contain a source of copper cations, Cl ions to improve anode dissolution and sulfuric acid to increase the conductivity of the solution (column 7, lines 58-67). Plating takes place over a thin seed layer (column 4, lines 19-22).

6. Claim 19 differs from the process of Dubin by reciting that the seed layer is cathodically polarized prior to or less than approximately 5 seconds following contact of the seed layer with the electroplating solution. As shown by Dubin et al, a typical copper plating bath contains sulfuric acid. The Condensed Chemical Dictionary teaches that sulfuric acid is strongly corrosive. Thus, one of ordinary skill in the art would recognize that the thin seed layer is vulnerable to etching and corrosion when it is immersed in the sulfuric acid-containing copper plating bath..

7. The Lashmore patent is directed to an electroplating process using an acidic electrolyte. One waveform used by Lashmore is the pulse waveform shown in figure

1. The current pulses are separated by an off time. Lashmore teaches that corrosion processes acting on the substrate in the plating bath may be reduced by applying a negative base current density during the off time, thereby providing cathodic protection (column 7, lines 14-18).

8. The Wright, Jr. Patent is directed to an electroplating process. Wright, Jr. Teaches that the technique of live entry, i.e. applying plating potential to the workpiece before it is immersed in the plating bath, is a recognized procedure which

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may improve plating results (column 3, lines 43-45). Using the live entry technique, deposition commences as soon as the workpiece enters the plating bath.

9. The prior art of record is indicative of the level of skill of one of ordinary skill in the art. It would have been obvious at the time the invention was made to have cathodically polarized the seed layer of the workpiece in the process of Dubin et al before or shortly after entry of the workpiece into the corrosive plating bath because the seed layer would have been cathodically protected as taught by Lashmore or deposition would have commenced immediately as taught by Wright, Jr., thus building up the thickness of the seed layer and avoiding corrosion. Both Lashmore and Wright, Jr. teach the application of dc cathodic current as recited in instant claim 21. Dubin et al teach that a current density of 5 milliamps per square centimeter as recited in instant claim 22 is suitable for copper deposition. See the examples.

Claim Rejections - 35 USC § 112

10. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

11. Claims 25 and 29-35 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

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12. In the next to last paragraph, claim 25 recites the step of increasing the current density from the second value such that electroplating progresses to bottoms of features having high diffusion-accessibility until the aspect ratios of all of the recessed features are less than approximately 0.5 and then, in the last paragraph recites the step of further increasing the current density to a third value providing a condition of conformal plating, filling the recessed features. The identification of the current density in the last paragraph as a "third value" is confusing. As noted, the next to last paragraph requires that the current density be increased from the second value. Thus, it appears that the current density in the next to last paragraph would be a third value, greater than the second value. The last paragraph calls for further increasing the current density. It appears that the current density of the last paragraph would be a fourth value, which is greater than the third value. Additionally, the preamble of claim 25 recites that the surface comprises a plurality of recessed features but does not indicate that the features have different aspect ratios. To be consistent with the next to last paragraph of the claim, which refers to electroplating progressing to bottoms of features having higher diffusion-accessibility, it appears that the preamble recite different aspect ratios. The dependent claims are rejected for the reasons given with respect to the claim upon which they depend.

Double Patenting

13. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

14. Claims 19, 21-25 and 29-39 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-22 of copending Application No. 09/796,856. Claim 1 of '856 includes a first step which corresponds to the step recited in instant claim 19. The steps of claim 1 of '856 corresponds to the steps of instant independent claims 25 and 36. Instant claim 25 recites the presence of "an additive" while claim 1 of '856 recites the presence of "a suppressor additive, an accelerator additive, and a leveler additive". Any one of these additives would meet the limitation of "an additive" in instant claim 25.

This is a provisional obviousness-type double patenting rejection.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to William Leader, whose telephone number is

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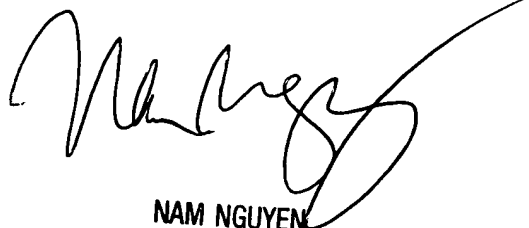
(703) 308-2530. The examiner can normally be reached Mondays-Thursdays and every other Friday from 7:30 AM to 4:00 PM eastern time.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached at (703) 308-3322. The fax phone number for *official* after final faxes is (703) 872-9311. The fax phone number for all other *official* faxes is (703) 872-9310. Unofficial communications to the Examiner should be faxed to (703) 305-7719.

Any inquiry of a general nature or relating to the status of this application should be directed to the receptionist whose telephone number is (703) 308-0661.

WL

William Leader:wtl
December 20, 2002


NAM NGUYEN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700